

## CLAIMS

What is claimed is:

1 1. A vehicle internetwork comprising a plurality of network elements  
2 including at least one node and at least one vehicle bus coupled among at least  
3 one peripheral electronic device, wherein functions of the plurality of network  
4 elements are remotely controllable, wherein the at least one node manipulates  
5 node information including configuration and security information to provide  
6 secure interoperability among the plurality of network elements and the at least  
7 one peripheral electronic device.

1 2. The vehicle internetwork of claim 1, wherein the at least one vehicle bus  
2 comprises at least one bus selected from a group consisting of at least one  
3 Original Equipment Manufacturer (OEM) bus, at least one Automotive  
4 Multimedia Interface Consortium (AMI-C) bus, at least one external network,  
5 and at least one local development network.

1 3. The vehicle internetwork of claim 2, wherein the at least one local  
2 development network accesses the at least one node for the performance of  
3 application upgrades, diagnostics, and programming.

1 4. The vehicle internetwork of claim 2, wherein the at least one local  
2 development network supports manipulation and transfer of entertainment  
3 software, wherein the entertainment software comprises at least one  
4 entertainment feature selected from a group consisting of video, audio, movies,  
5 television shows, music, games, and simulations.

1 5. The vehicle internetwork of claim 1, wherein the at least one vehicle bus  
2 comprises at least one legacy automotive bus selected from a group consisting  
3 of Audio Control Protocol (ACP) buses and Standard Corporate Protocol (SCP)  
4 buses.

1 6. The vehicle internetwork of claim 1, wherein the at least one peripheral  
2 electronic device comprises at least one device coupled to at least one OEM bus

3 selected from a group consisting of climate control devices, actuator devices,  
4 position location devices, Global Positioning System (GPS) devices,  
5 communication devices, cellular telephony devices, processing devices,  
6 diagnostic devices, modems, video devices, audio devices, multimedia devices,  
7 electronic game devices, sensor devices, switch devices, and device  
8 subnetworks.

1 7. The vehicle internetwork of claim 1, wherein the at least one peripheral  
2 electronic device comprises at least one device coupled to at least one AMI-C  
3 bus selected from a group consisting of communication devices, position  
4 location devices, GPS devices, communication devices, pager devices, cellular  
5 telephony devices, processing devices, modems, video devices, audio devices,  
6 multimedia devices, electronic game devices, personal digital assistants (PDAs),  
7 and wireless local area network (LAN) devices.

1 8. The vehicle internetwork of claim 1, wherein the at least one node  
2 comprises at least one interface port selected from a group consisting of  
3 Intelligent Data Bus (IDB-C) ports, MOST ports, Institute of Electrical and  
4 Electronics Engineers (IEEE) 1394 ports, On-Board Diagnostic-II (OBD-II)  
5 ports, Standard Corporate Protocol (SCP) ports, Audio Control Protocol (ACP)  
6 ports, Bluetooth ports, Personal Communications Service (PCS) ports, Global  
7 System for Mobile Communications (GSM) ports, and Ethernet ports.

1 9. The vehicle internetwork of claim 1, wherein the functions are hosted on  
2 a central network element, wherein the functions are distributed among the  
3 plurality of network elements in response to a coupling of additional peripheral  
4 electronic devices to the at least one vehicle bus.

1 10. The vehicle internetwork of claim 1, wherein the at least one node  
2 includes at least one gateway node and at least one port node, wherein the at  
3 least one node provides at least one function selected from a group consisting of  
4 data processing, data storage, access control, protocol translation, security  
5 including service discovery and device authentication, and network control.

1       11.     The vehicle internetwork of claim 10, wherein the at least one gateway  
2     comprises at least one interface port, at least one real-time interface processor  
3     (RTIP), and at least one application processor, wherein the at least one RTIP  
4     performs real-time operations and the at least one application processor  
5     performs high level processing functions.

1       12.     The vehicle internetwork of claim 11, wherein the at least one gateway  
2     functions as an Internet Protocol (IP) router, wherein the at least one RTIP  
3     comprises a high-speed bus controlled by at least one coupled device.

1       13.     The vehicle internetwork of claim 11, wherein the at least one interface  
2     port has at least one function selected from a group consisting of a tag, a bridge,  
3     and an interface.

1       14.     The vehicle internetwork of claim 11, wherein the at least one interface  
2     port includes at least one port selected from a group consisting of wired  
3     communication ports and wireless communication ports.

1       15.     The vehicle internetwork of claim 10, wherein the at least one gateway  
2     includes a first gateway coupled to a second gateway.

1       16.     The vehicle internetwork of claim 10, wherein the at least one port node  
2     is coupled to at least one subnetwork.

1       17.     The vehicle internetwork of claim 10, wherein the at least one gateway  
2     node couples a first vehicle bus and a second vehicle bus, wherein the at least  
3     one port node couples the at least one vehicle bus to the at least one peripheral  
4     electronic device.

1       18.     The vehicle internetwork of claim 10, wherein the at least one port node  
2     comprises at least one device selected from a group consisting of at least one  
3     processor, at least one memory cache, at least one wireless modem, at least one  
4     network protocol, at least one policy, and at least one wired local area network  
5     (LAN).

1       19.     The vehicle internetwork of claim 10, wherein the at least one port node  
2     comprises at least one device selected from a group consisting of at least one  
3     micro real-time interface processor (RTIP), at least one appliance interface, at  
4     least one communication interface, and at least one memory device.

1       20.     The vehicle internetwork of claim 19, wherein the at least one appliance  
2     interface is coupled to at least one sensor, wherein the at least one  
3     communication interface is coupled to at least one radio.

1       21.     The vehicle internetwork of claim 10, wherein the at least one port node  
2     comprises at least one port node selected from a group consisting of a serial  
3     network interface connector (SNIC) and a public network port (PNP), wherein  
4     the at least one port node interacts with at least one corresponding proxy to  
5     enable the at least one peripheral electronic device to operate within the  
6     network.

1       22.     The vehicle internetwork of claim 1, wherein the at least one node  
2     comprises at least one hybrid switch, wherein the at least one hybrid switch  
3     includes at least one interface port coupled among at least one switch of a first  
4     speed and at least one switch of a second speed, wherein each of the at least one  
5     switch of a first speed and the at least one switch of a second speed are coupled  
6     to at least one port.

1       23.     The vehicle internetwork of claim 1, wherein the at least one hybrid  
2     switch distributes at least one switching function among the plurality of network  
3     elements of a host vehicle.

1       24.     The vehicle internetwork of claim 22, wherein at least one application of  
2     a first type is coupled through the at least one port to the at least one switch of a  
3     first speed, wherein at least one application of a second type is coupled through  
4     the at least one port to the at least one switch of a second speed.

6       25.     The vehicle internetwork of claim 1, wherein the at least one node  
7     couples to at least one subnetwork, wherein the at least one subnetwork  
8     comprises at least one device selected from a group consisting of sensor  
9     devices, actuator devices, wired network devices, and wireless network devices.

1       26.     The vehicle internetwork of claim 1, further comprising at least one  
2     router that couples to the Internet using at least one device selected from a  
3     group consisting of at least one bus and at least one communication device,  
4     wherein the at least one bus is selected from a group consisting of an IEEE 1394  
5     bus, a MOST bus, an IDB-C bus, and an Ethernet bus, wherein the at least one  
6     communication device is selected from a group consisting of a Bluetooth  
7     modem, an IEEE 802.11 radio, and a mobile telephone.

1       27.     The vehicle internetwork of claim 1, wherein the at least one node  
2     generates at least one hierarchy of communication alternatives in response to a  
3     determined position of a host vehicle, wherein a selected communication  
4     alternative is used to communicate with at least one local site.

1       28.     The vehicle internetwork of claim 1, wherein data processing is  
2     controlled using at least one processing hierarchy that controls at least one event  
3     selected from a group consisting of data classifications, data transfers, data  
4     queuing, data combining, processing locations, and communications among the  
5     plurality of network elements.

1       29.     The vehicle internetwork of claim 1, wherein the functions are  
2     distributed among the plurality of network elements.

1       30.     The vehicle internetwork of claim 1, wherein the functions of the at least  
2     one node include at least one function selected from a group consisting of data  
3     acquisition, data processing, communication management, data routing, data  
4     security, programming, node operation, protocol translation, network  
5     management, and interfacing with at least one communication physical layer  
6     including cellular telephony, wireline telephone, satellite telephony, packet  
7     radio, microwave, optical.

1       31.     The vehicle internetwork of claim 30, wherein data processing functions  
2     of at least one peripheral electronic device are distributed among at least one  
3     other processor selected from a group consisting of the at least one node and the  
4     at least one peripheral electronic device.

1       32.     The vehicle internetwork of claim 1, wherein the at least one node  
2     implements at least one security method selected from a group consisting of  
3     confounder codes, encrypted transmissions, security policy-based  
4     communication protocols, blocking coupling with unauthorized devices, and  
5     blocking commands from at least one class of device.

1       33.     The vehicle internetwork of claim 32, wherein the at least one security  
2     method is implemented in at least one gateway node and at least one port node.

1       34.     The vehicle internetwork of claim 32, wherein the at least one security  
2     method includes blocking denial of service attacks by decoupling at least one  
3     port node through which unauthorized access is attempted and blocking at least  
4     one application at a decoupled port node.

1       35.     The vehicle internetwork of claim 32, wherein the at least one security  
2     method further includes at least one method selected from a group consisting of  
3     an ignition key, a password device, and a security display.

1       36.     The vehicle internetwork of claim 32, wherein the at least one security  
2     method further includes a designated authorization port, wherein at least one  
3     connector is coupled to the designated authorization port to receive  
4     authorization for coupling a device to the plurality of network elements.

1       37.     The vehicle internetwork of claim 1, wherein the plurality of network  
2     elements automatically organize in response to the node information, wherein  
3     the automatic organizing comprises automatically controlling data transfer,  
4     processing, and storage among the plurality of network elements.

1       38. The vehicle internetwork of claim 1, wherein at least one level of  
2       synchronization is supported among different subsets of the plurality of network  
3       elements, wherein a first level of synchronization is supported among a first  
4       subset of the plurality of network elements, wherein a second level of  
5       synchronization is supported among a second subset of the plurality of network  
6       elements.

1       39. The vehicle internetwork of claim 1, wherein the plurality of network  
2       elements are self-assembling, wherein search and acquisition modes of the at  
3       least one node search for participating ones of the plurality of network elements,  
4       wherein a determination is made whether each of the participating ones of the  
5       plurality of network elements are permitted to join the vehicle internetwork  
6       using a message hierarchy, wherein the plurality of network elements are  
7       surveyed at random intervals for new nodes and missing nodes.

1       40. The vehicle internetwork of claim 1, wherein the plurality of network  
2       elements are self-assembled into a multi-cluster network, wherein a start node is  
3       selected as a base node, wherein the base node communicates an assembly  
4       packet throughout the vehicle internetwork, wherein information of the  
5       assembly packet alternates with each successive communication between  
6       directing a node to become a base node of a particular cluster number and  
7       directing a node to become a remote node of a particular cluster number,  
8       wherein the particular cluster number is incrementally changed with each  
9       successive communication of the assembly packet.

1       41. The vehicle internetwork of claim 1, wherein the at least one node  
2       performs service discovery, wherein service discovery comprises synchronizing  
3       the at least one node, authenticating the at least one node, determining at least  
4       one communication mode for the at least one node, and informing the at least  
5       one node of resources available among the plurality of network elements.

1       42. The vehicle internetwork of claim 1, wherein data is collected by the at  
2       least one node, wherein at least one operation is performed on the data in

3 response to parameters established by a user, the at least one operation selected  
4 from a group consisting of classification, routing, processing, storing, and  
5 fusing.

1 43. The vehicle internetwork of claim 42, wherein the data is vehicle  
2 diagnostic data, wherein diagnostic operations are performed in response to the  
3 data.

1 44. The vehicle internetwork of claim 42, wherein routing comprises  
2 selecting at least one communication type and at least one communication  
3 coupling for use in routing the collected data.

1 45. The vehicle internetwork of claim 42, wherein routing comprises  
2 selecting at least one data type for routing, selecting at least one of the plurality  
3 of network elements to which to route the selected data, selecting at least one  
4 route to the selected at least one of the plurality of network elements, and  
5 routing the selected at least one data type to the selected at least one of the  
6 plurality of network elements.

1 46. The vehicle internetwork of claim 42, wherein processing comprises  
2 selecting at least one data type for processing, selecting at least one processing  
3 type, selecting at least one of the plurality of network elements to perform the  
4 selected at least one processing type, and transferring the selected at least one  
5 data type to the selected at least one of the plurality of network elements using  
6 at least one route through the sensor network.

1 47. The vehicle internetwork of claim 46, wherein data processed in a  
2 plurality of nodes is aggregated for further processing by other nodes.

1 48. The vehicle internetwork of claim 46, wherein data processed by the at  
2 least one node is aggregated for reporting to at least one user.

1 49. The vehicle internetwork of claim 42, wherein storing comprises  
2 selecting at least one data type for storage, selecting at least one storage type,

3 selecting at least one of the plurality of network elements to perform the  
4 selected at least one storage type, and transferring the selected at least one data  
5 type to the selected at least one of the plurality of network elements using at  
6 least one route through the plurality of network elements.

1 50. The vehicle internetwork of claim 42, wherein fusing comprises a first  
2 node transmitting at least one query request to at least one other node, wherein  
3 the first node collects data from the at least one other node in response to the at  
4 least one query request, and processes the collected data.

1 51. The vehicle internetwork of claim 1, wherein the plurality of network  
2 elements comprise a plurality of application programming interfaces (APIs),  
3 wherein the APIs include APIs for application support, database services,  
4 routing, security, network management, and deployment.

1 52. The vehicle internetwork of claim 51, wherein the APIs for application  
2 support, database services, and routing are hosted on at least one gateway node,  
3 wherein the APIs for security, network management, and deployment are shared  
4 among at least one gateway node and at least one port node.

1 53. The vehicle internetwork of claim 51, wherein the plurality of APIs are  
2 layered, wherein the plurality of APIs enable distributed resource management  
3 by providing network resource information among the plurality of network  
4 elements, wherein information transfer among the plurality of network elements  
5 is controlled using a synchronism hierarchy established in response to the  
6 network resource information.

1 54. The vehicle internetwork of claim 1, wherein the plurality of network  
2 elements support atomic transaction methods.

1 55. The vehicle internetwork of claim 1, wherein the at least one node  
2 includes sensing, processing, communications, and storage devices supporting a  
3 plurality of processing and protocol layers.

1       56.     The vehicle internetwork of claim 1, wherein the at least one node  
2     supports at least one communication mode selected from a group consisting of  
3     wireless communications, wired communications, and hybrid wired and  
4     wireless communications.

1       57.     The vehicle internetwork of claim 1, wherein the at least one node is  
2     coupled to the at least one remote computer using the plurality of network  
3     elements, wherein the plurality of network elements includes at least one  
4     element selected from a group consisting of at least one station gateway, at least  
5     one server, at least one repeater, at least one interrogator, and at least one  
6     network, wherein the at least one network includes wired networks, wireless  
7     networks, and hybrid wired and wireless networks.

1       58.     The vehicle internetwork of claim 57, wherein the at least one network  
2     comprises at least one network selected from a group comprising the Internet,  
3     local area networks, wide area networks, metropolitan area networks, and  
4     information service stations.

1       59.     The vehicle internetwork of claim 57, wherein the plurality of network  
2     elements provides remote accessibility using World Wide Web-based tools to  
3     data, code, control, and security functions, wherein data includes signals,  
4     wherein code includes signal processing, decision support, and database  
5     elements, and wherein control includes operation of the plurality of network  
6     elements.

1       60.     The vehicle internetwork of claim 1, wherein the plurality of network  
2     elements comprise a plurality of network element sets, wherein the plurality of  
3     network element sets are layered.

1       61.     The vehicle internetwork of claim 1, wherein the at least one node  
2     comprises a plurality of node types, wherein the plurality of node types includes  
3     at least one node of a first type and at least one node of a second type, wherein a  
4     first network having a first node density is assembled using the at least one node

5 of a first type, wherein a second network having a second node density is  
6 assembled using the at least one node of a second type, wherein the second  
7 network is overlaid onto the first network.

1 62. The vehicle internetwork of claim 1, wherein software and data are  
2 transferable among the plurality of network elements, wherein the transfer is  
3 remotely controllable, wherein the software and the data are downloadable from  
4 at least one location selected from a group consisting of storage devices of the  
5 plurality of network elements, external storage devices, and remote storage  
6 devices.

1 63. The vehicle internetwork of claim 1, wherein the plurality of network  
2 elements are managed as a distributed and active database using a distributed  
3 resource management protocol, wherein the plurality of network elements are  
4 reused among different applications, wherein the network elements are used in  
5 multiple classes of applications.

1 64. The vehicle internetwork of claim 1, further comprising at least one  
2 database, wherein the at least one database includes at least one storage device  
3 selected from a group consisting of storage devices coupled to at least one of the  
4 plurality of network elements and storage devices of the at least one node.

1 65. The vehicle internetwork of claim 1, wherein at least one coupling  
2 among the at least one node and at least one external network supports data  
3 transfer among the at least one node of a host vehicle, wherein the data includes  
4 vehicle service data, diagnostic data, maintenance history data, security data,  
5 electronic mail, and entertainment software.

1 66. The vehicle internetwork of claim 1, wherein at least one coupling  
2 among the at least one peripheral electronic device and at least one external  
3 network supports data transfer among the at least one node of a host vehicle,  
4 wherein the data includes vehicle service data, diagnostic data, maintenance  
5 history data, security data, electronic mail, and entertainment software.

1       67.     The vehicle internetwork of claim 1, wherein the at least one node is  
2     coupled to at least one diagnostic device of a host vehicle.

1       68.     The vehicle internetwork of claim 1, wherein the at least one node  
2     comprises at least one diagnostic node of a host vehicle.

3       69.     The vehicle internetwork of claim 1, wherein the at least one node  
4     manipulates at least one data item selected from a group consisting of vehicle  
5     assembly data, vehicle maintenance data, vehicle diagnostics data, vehicle  
6     position data, vehicle operations profile data, fleet management data, fleet  
7     reliability analysis data, security system data, entertainment system data, and  
8     targeted advertising data.

1       70.     The vehicle internetwork of claim 1, wherein at least one subset of the  
2     plurality of network elements comprise at least one sensor network, wherein the  
3     at least one subset further includes at least one sensor node, at least one gateway  
4     station, at least one server, at least one gateway network, and at least one client  
5     computer hosting a World Wide Web browser, wherein the at least one node is  
6     configured as the at least one gateway station and the at least one sensor node.

1       71.     The vehicle internetwork of claim 70, wherein the at least one sensor  
2     node is coupled among a monitored environment and the at least one client  
3     computer, wherein functions of the at least one sensor node are remotely  
4     controllable using the at least one client computer, wherein the at least one  
5     sensor node provides the node information including node resource cost and  
6     message priority to the plurality of network elements, wherein data processing  
7     is distributed among the plurality of network elements in response to the node  
8     information.

1       72.     The vehicle internetwork of claim 70, wherein at least one redundant  
2     communication pathway is established among the plurality of network elements.

1    73.    The vehicle internetwork of claim 70, wherein the at least one gateway  
2    station performs at least one function selected from a group consisting of  
3    protocol translation, sensor network management, management of transmissions  
4    from a remote user, and interfacing with at least one communication physical  
5    layer including wired local area networks, packet radio, microwave, optical,  
6    wireline telephony, cellular telephony, and satellite telephony.

1    74.    The vehicle internetwork of claim 70, wherein the at least one gateway  
2    network includes wired networks, wireless networks, and hybrid wired and  
3    wireless networks, wherein the at least one gateway network comprises at least  
4    one network selected from a group comprising the Internet, local area networks,  
5    wide area networks, metropolitan area networks, and information service  
6    stations.

1    75.    A vehicle internetwork comprising a plurality of network elements  
2    including at least one electronic device coupled among at least one node and at  
3    least one vehicle bus, wherein the plurality of network elements are remotely  
4    accessible via at least one wireless Internet coupling with at least one remote  
5    computer, wherein the plurality of network elements manipulate network data  
6    including configuration and security data to provide secure interoperability  
7    among the plurality of network elements.

1    76.    A vehicle internetwork, comprising:  
2        means for coupling a plurality of network elements including at least  
3        one node and at least one vehicle bus among at least one peripheral electronic  
4        device;  
5        means for manipulating node information including configuration and  
6        security information;  
7        means for automatically assembling and configuring the plurality of  
8        network elements in response to the node information;  
9        means for remotely controlling at least one function of the plurality of  
10      network elements; and

11       means for providing secure interoperability among the plurality of  
12   network elements in response to the node information.